TABLE 3.—*Maximum free-air wind velocities (meters per second) for different sections of the United States based on pilot-balloon observations during May 1938*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station
Northeast [1]	40.4	NW	2,440	17	Newark, N. J.	40.4	NW	3,600	2	Albany, N. Y.	35.2	NW	5,940	1	Albany, N. Y.
East-Central [2]	36.1	SW	1,870	23	Cincinnati, Ohio	42.4	NW	4,680	16	Greensboro, N. C.	36.2	N	10,440	31	Greensboro, N. C.
Southeast [3]	32.0	W	2,260	15	Jacksonville, Fla.	38.0	W	3,640	14	Atlanta, Ga.	35.2	WNW	9,280	14	Key West, Fla.
North-Central [4]	30.5	WSW	1,320	2	Bismark, N. Dak.	57.6	WSW	4,800	13	Huron, S. Dak.	54.0	N	10,200	12	Huron, S. Dak.
Central [5]	34.7	S	970	4	St. Louis, Mo.	38.0	NW	3,140	15	St. Louis, Mo.	36.8	W	6,460	8	Wichita, Kans.
South-Central [6]	29.7	S	1,360	3	Brownsville, Tex.	29.1	SSW	3,730	3	Amarillo, Tex.	39.4	NNW	10,660	26	Del Rio, Tex.
Northwest [7]	26.8	WSW	2,160	12	Pendleton, Oreg.	33.5	NW	3,970	13	Missoula, Mont.	47.0	W	7,340	30	Medford, Oreg.
West-Central [8]	37.5	SSW	2,280	18	Modena, Utah	41.4	NW	4,780	2	Sacramento, Calif.	52.8	WSW	8,420	19	Modena, Utah.
Southwest [9]	32.8	WSW	2,300	12	Havre, Mont.	34.4	NW	4,700	4	Fresno, Calif.	55.0	WSW	6,500	1	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

Precipitation during May 1938 was above normal in practically all sections, except the Southwest and extreme West. Kansas and Minnesota received more than twice the normal amount, and in the Ohio Valley and most of the Great Plains the rainfall was substantially above normal. Severe local flooding resulted principally in the rivers which drain the Kansas and Minnesota regions.

Upper Mississippi Basin.—High water prevailed over much of this section during the month. This was due to two distinct periods of heavy rains over Minnesota, Iowa, and Wisconsin during May 2–9 and May 14–28. In the first period the heaviest rainfall was centered north of the Twin Cities in Minnesota. This resulted in abnormally high lake levels and caused disastrous flood conditions in the Aitken County area in Minnesota. The report on the floods in this area was not received in time for inclusion in the May issue of the REVIEW, but will be included in the next issue.

The following report was submitted by the official in charge of the La Crosse, Wis., district, which consists of the Mississippi River and tributaries from below St. Paul, Minn., to and including La Crosse:

High water prevailed during the entire month of May in the district. The highest stage at La Crosse since April 1922 occurred when the crest reached 13.7 feet, although the crest in March 1936 was only 0.1 foot lower. Practically the same relative differences prevailed at Winona, Minn., for those years. In the upper section of the district from Lake Pepin to Hastings, Minn., the flood conditions were comparable to 1922, and crest stages averaged only 0.3 to 0.4 foot lower than in that year. The high water in May 1938 was characterized by two gradual rises covering the periods 1–13 and 18–27. During the first period the average rise was 5.0 feet and during the second period 1.2 feet throughout the district. The second rise was really a secondary crest produced by additional heavy rains just after it had begun to fall after the first period of prolonged rains.

The present occurrence of high water was by no means due to melting snow in the headwaters, as the crest resulting from this run-off appeared throughout the district from March 26 to March 31. It was due wholly to two distinct periods of heavy rains extending from the 2d to the 9th and from the 14th to 28th. The first of these periods resulted in a large reserve of water in the section north of the Twin Cities, resulting in turn in abnormally high lake levels and causing disastrous flood conditions in the Aitken, Minn., area. The May totals of rainfall show an unusual condition in that the amounts increased from La Crosse northward. The reverse is generally the case, larger amounts occurring in the southern section of the district. The following May rainfall totals will indicate this as well as to show that the amounts vary in excess of normal amounts from +1.11 inches at La Crosse to +7.28 at Hastings: La Crosse, 4.86; Dam No. 7, 5.90; Hatfield, 5.75; Dam No. 6, 4.87; Winona, 6.87; Dam No. 5A, 8.24; Beaver, 4.52; Dam No. 5, 6.12; Dam No. 4, 7.11; Durand (Chippewa), 9.41; Reads, 8.52; Red Wing, 9.20; Dam No. 3, 9.38; Hastings, 10.95. The lower Chippewa Valley had as large an excess as the vicinity of Hastings, and the Chippewa River contributed materially to high-water stages from Reads, Minn., southward, especially in the secondary crest occurring at Winona and La Crosse on the 24th. The Chippewa at Durand, Wis., discharged slightly over 50,000 second-feet at the flood stage of 11 feet on the 7th and 21st. The Black River contributed materially to flood stage at La Crosse on the 24th and 25th, caused by the release of a large volume of water from the Hatfield power dam.

The flood conditions in the Dubuque, Iowa, district, comprising the Mississippi River and tributaries from below La Crosse, Wis., to and including Dubuque, are reported by the official in charge at that place:

The Mississippi was unusually high for May, the average stage at Dubuque being 13.2 feet. There were two separate rises, the second beginning 5 days after the occurrence of the first crest. The river was falling at the beginning of the month, the lowest stage, 9.19, being reached in the afternoon of the 4th. It then began to rise due to general high-water conditions throughout the upper Mississippi Valley. The Wisconsin River crest passed downstream before the arrival of the upper Mississippi crest, and thereby reduced the severity of this rise at points near and below the mouth of the Wisconsin River. The crest gave a stage of 15.7 feet at Dubuque on the 20th. Further substantial rains, particularly in northern Wisconsin, produced new floods in many of the tributaries above La Crosse. In this case the times of arrival of crests from above La Crosse and from the Wisconsin River bore normal relations to each other, which favored somewhat higher stages than in the case of the preceding crest. An additional factor was the occurrence at Dubuque of still further heavy rainfall on the 27th. The final result was a crest of 17.15 feet on May 30. This was the highest river stage at Dubuque since April 1922.

The approach of the crest in the extreme upper Mississippi, together with further local heavy rains, caused the lower half of the upper Mississippi to slightly exceed flood stage, principally from Quincy to Alton, Ill., during the last few days of the month. Low places along the river were overflowed but only slight damage occurred.

Missouri and Arkansas Basin.—Unusually heavy rains, centered mainly over Kansas, during May resulted in widespread floods in that area. In the Missouri River drainage, floods occurred principally in the Solomon, Osage, Gasconade, and the Missouri River itself at Hermann and St. Charles, Mo. In the Arkansas River drainage, the floods were confined mainly to the Cottonwood, Neosho, Cimarron, Verdigris, Ninnescah, North and South Canadian, and in the Arkansas River from Ralston, Okla., to Dardanelle, Ark.

The overflows of the Solomon River were slight and little or no damage resulted.

The Cottonwood River overflooed slightly at Emporia, Kans., on the 7th and again on the 13th, but heavy rains on the 19th resulted in a serious flood in this river and in creeks in Chase and Lyon Counties, with damage, mostly to growing crops, estimated at more than $200,000. The river was above bankful from the 19th to the 26th at Emporia and crested at 24.4 feet (4.4 feet above flood stage) on the 24th.

The Osage River reached a high stage near the Kansas-Missouri boundary, with a loss of $76,200. At La Cygne, Kans., the river reached a crest of 26.0 feet on May 26 (5.0 feet above bankful stage).

The Neosho River flood was still in progress at the close of the month and a report concerning it will be included in the next issue of the REVIEW.

Heavy rains on the 19th over south-central and southeastern Kansas resulted in high water in the Walnut, Verdigris, and Ninnescah Rivers and many smaller streams in that area, and caused damages totaling approximately $370,000.

High water in the North and South Canadian Rivers from May 19–31 caused damages slightly exceeding $40,000.

The heavy discharges from the tributaries in Kansas and eastern Oklahoma brought stages in the Arkansas above flood stage as far downstream as Dardanelle, Ark., with an estimated loss of about $100,000.

Lower Mississippi Basin.—The Tallahatchie River which has been in flood in the vicinity of Swan Lake, Miss., since January 28, subsided during May, passing below flood stage on May 11—about 4,000 acres of cleared land was under water much of this time.

West Gulf of Mexico Drainage.—Flooding continued from April in the Sabine and lower Trinity Rivers, remaining above flood stage until May 9. The Trinity crested at Liberty, Tex., on May 1, with a stage of 26.5 feet, and at Logansport, La., on the Sabine River, May 3–4, with a stage of 27.4 feet. The report of the damage was included in the report for April.

The Guadalupe River was above flood stage at Victoria, Tex., at the beginning of May and this was followed by two more rises on May 10 and 17. The latter rise was caused by a local heavy rain. The amount of damage caused by the floods in the Guadalupe River from April 26 to May 17 has been estimated at about $236,000, largely to prospective crops.

Colorado River Basin.—Light floods occurred in the Eagle River, Roaring Fork River, and Gunnison River, all tributaries of the Colorado River in Colorado, during the month. The floods in the two former streams occurred at the close of the month but in the Gunnison River there were three separate rises, on the 1st, 15th, and the 27th. No damage of consequence has been reported.

Pacific Slope Drainage.—High stages prevailed in the San Joaquin Basin during the month. The snow depths in the Sierra Nevada Mountains near the end of March were greater than for many years past. This, together with the fact that the March rains left the streams high at the beginning of the spring snow melting season, accounts for the high water during May.

Kings River was above flood stage at Piedra, Calif., from May 13 to 19, and from May 24, with the latter rise in progress at the close of the month. The San Joaquin was also out of its banks at the end of the month.

The Columbia River and a few of its tributaries exceeded flood stage late in the month. As the floods in both the San Joaquin and Columbia basins continued into June a full report will be made later.

Table of flood stages during May 1938

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ST. LAWRENCE DRAINAGE					
Lake Huron					
	Feet			*Feet*	
Cass: Vassar, Mich	13	24	24	13.2	24
EAST GULF OF MEXICO DRAINAGE					
Pearl: Pearl River, La	12	Mar. 27	8	17.0	Apr. 13
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Chippewa: Durand, Wis	11	7	7	11.0	7
		21	22	11.3	21, 22
Wisconsin:					
Merrill, Wis	11	5	5	11.0	5
Knowlton, Wis	12	5	6	13.4	5
		20	21	13.1	21
Bourbeuse: Union, Mo	12	25	26	12.4	25
Meramec:					
Sullivan, Mo	11	23	25	16.8	24
Pacific, Mo	11	23	27	16.8	25
Valley Park, Mo	14	24	28	22.5	25
Mississippi:					
Fort Ripley, Minn	10	8	19	10.8	10, 11
La Crosse, Wis	12	24	25	12.0	24, 25
Quincy, Ill	14	22	24	14.1	24
Hannibal, Mo	13	20	(1)	14.3	24
Louisiana, Mo	12	22	(1)	13.8	25
Alton, Ill	21	26	28	21.4	27
Chester, Ill	27	28	28	27.1	28
Missouri Basin					
Solomon: Beloit, Kans	18	27	27	21.4	27
		31	31	20.0	31
Osage:					
Osceola, Mo	20	25	(1)	24.9	30
Lakeside, Mo	60	22	30	60.7	24, 25
St. Thomas, Mo	23	23	31	25.8	27
Gasconade: Jerome, Mo	15	24	25	15.6	24
Missouri:					
Hermann, Mo	21	24	26	21.8	25
St. Charles, Mo	25	24	28	26.9	26
Ohio Basin					
Hocking: Athens, Ohio	17	21	23	18.4	22
		24	25	18.5	25
West Fork of White:					
Elliston, Ind	18	23	25	19.0	24
Edwardsport, Ind	12	23	28	16.6	26
Ohio: Cairo, Ill	40	29	June 3	41.2	31, June 1
White Basin					
Current: Doniphan, Mo	10	24	26	13.4	25
Black: Black Rock, Ark	14	28	31	15.2	29
White:					
Calico Rock, Ark	18	23	25	24.4	23
Batesville, Ark	23	24	27	29.0	24
Georgetown, Ark	21	Mar. 31	3	(2)	
		28	June 8	29.7	June 1
Clarendon, Ark	26	Apr. 3	9	(2)	
Arkansas Basin					
Cimarron: Perkins, Okla	11	20	20	12.8	20
		23	25	13.0	24
Verdigris: Sageeyah, Okla	35	25	30	37.3	29
Cottonwood: Emporia, Kans	20	6	7	21.0	7
		12	13	20.6	13
		19	26	23.5	21
				24.4	24

See footnotes at end of table.

Table of flood stages during May 1938—Continued

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates From—	Above flood stages—dates To—	Crest Stage	Crest Date
MISSISSIPPI SYSTEM—continued					
Arkansas Basin—Continued					
Neosho:	*Feet*			*Feet*	
Neosho Rapids, Kans	22	20	26	24.2	21
LeRoy, Kans	23	12	13	25.0	12, 13
		19	28	27.8	23
		30	30	23.6	30
Iola, Kans	15	14	14	15.5	14
		20	(1)	20.5	24
Oswego, Kans	17	22	(1)	23.3	30
Fort Gibson, Okla	22	26	26	22.0	26
		31	(1)		
North Canadian:					
Canton, Okla	6	5	8	7.5	7
		18	21	11.0	19
		22	26	8.3	24
		Apr. 28	2	10.2	Apr. 29
Yukon, Okla	8	4	12	11.2	8
		19	(1)	12.6	22
(East) Oklahoma City, Okla	14	22	23	14.6	22, 23
Arkansas:					
Ralston, Okla	16	22	23	16.4	22, 23
Webbers Falls, Okla	23	24	28	23.9	26
Fort Smith, Ark	22	23	29	25.0	25
Van Buren, Ark	22	23	30	25.1	25, 26
Dardanelle, Ark	22	25	28	22.8	26
Red Basin					
Ouachita: Monroe, La	40	Apr. 16	5	(2)	
Black: Jonesville, La	50	Apr. 7	14	(2)	
Lower Mississippi Basin					
St. Francis: Fisk, Mo	20	25	27	22.4	26
Tallahatchie: Swan Lake, Miss	26	Jan. 28	11	31.0	Apr. 12, 13
Yazoo: Yazoo City, Miss	29	Apr. 10	10	30.53	Apr. 30
Mississippi:					
Angola, La	45	Apr. 17	7	(2)	
Baton Rouge, La	35	Apr. 16	8	(2)	
Plaquemine, La	31	Apr. 17	8	(2)	
Donaldsonville, La	28	Apr. 20	6	(2)	
Reserve, La	22	Apr. 27	1	(2)	

Table of flood stages during May 1938—Continued

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates From—	Above flood stages—dates To—	Crest Stage	Crest Date
MISSISSIPPI SYSTEM—continued					
Atchafalaya Basin					
Atchafalaya:	*Feet*			*Feet*	
Melville, La	37	Apr. 17	8	38.5	Apr. 27-1
Atchafalaya, La	25	Apr. 27	2	25.0	Apr. 27-2
Morgan City, La	6	4	4	6.0	4
		6	7	6.1	7
WEST GULF OF MEXICO DRAINAGE					
Sabine: Logansport, La	25	Apr. 20	10	27.4	3, 4
Trinity: Liberty, Tex	24	Apr. 9	9	26.5	Apr. 30, 1
		Apr. 25	2	28.7	Apr. 30
Guadalupe: Victoria, Tex	21	9	11	23.0	10
		16	17	27.3	17
Rio Grande: Espanola, N. Mex	7	19	21	7.1	21
GULF OF CALIFORNIA DRAINAGE					
Colorado Basin					
Eagle: Eagle, Colo	5	29	(1)	5.4	31
Roaring Fork: Carbondale, Colo	5	28	(1)	6.2	30
North Fork of Gunnison: Paonia, Colo	9	Apr. 30	1	9.3	1
		14	18	10.0	16
		27	30	9.8	29
Gunnison: Delta, Colo	9	Apr. 23	2	10.8	1
		14	19	10.2	16
		27	(1)	11.2	30
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Kings: Piedra, Calif	10	13	19	11.9	15
		24	(1)		
San Joaquin: Lathrop, Calif	17	28	(1)		
Columbia Basin					
Kootenai: Bonners Ferry, Idaho	31	29	June 1	31.5	30
Clearwater: Kamiah, Idaho	12	1	1	12.3	1
		24	June 3	14.6	29
Williamette: Portland, Oreg	18	29	(1)	20.6	31
Columbia: Vancouver, Wash	15	3	7	16.1	5
		26	(1)		

[1] Continued into next month.
[2] Crest occurred previous month.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, W. E. HURD acting in charge]

NORTH ATLANTIC OCEAN, MAY 1938

By H. C. HUNTER

Atmospheric pressure.—As in the preceding month most of the North Atlantic had pressure greater than normal during May, though the departures from normal were not marked this month. The greatest positive departures were 0.13 inch at Lerwick, Shetland Islands, and 0.12 inch at Madeira. The central part of the North Atlantic had pressure somewhat above normal, and near Iceland also; around the Greater Antilles and over much of the Gulf of Mexico there was a slight excess.

From near southern Greenland to the waters east of Florida and the Bahamas there was a moderate deficiency of pressure.

Among the barometer readings so far secured from vessels the extremes of the month are found to be 30.53 and 28.82 inches. The higher reading was noted on the forenoon of the 23d, by the British steamship *Tucurinca*, about 500 miles to west-northwest of the northwestern coast of Spain. The lower reading was noted early on the 4th about 400 miles northeast of St. Johns, Newfoundland, by the British liner *Duchess of Richmond*.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, May 1938*

Stations	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.81	−0.04	30.32	6	29.28	1
Reykjavik, Iceland	29.96	+.04	30.51	4	29.47	31
Lerwick, Shetland Islands	29.93	+.13	30.39	2, 4	29.44	29
Valencia, Ireland	29.95	.00	30.39	22	29.38	26
Lisbon, Portugal	30.08	+.11	30.32	12	29.68	5
Madeira	30.13	+.12	30.27	11, 12	29.94	5
Horta, Azores	30.26	+.10	30.46	18	30.08	12
Belle Isle, Newfoundland	29.87	−.02	30.44	29	29.28	2
Halifax, Nova Scotia	29.93	−.04	30.50	30	29.38	16
Nantucket	29.93	−.06	30.40	31	29.20	15
Hatteras	29.96	−.05	30.23	31	29.58	14
Bermuda	30.06	−.05	30.34	26	29.82	5
Turks Island	30.01	+.01	30.08	1, 2	29.92	6
Key West	29.98	+.01	30.14	2	29.85	5
New Orleans	29.98	+.01	30.15	1	29.68	7

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—The month was less stormy than the average May, particularly over the eastern regions. From the 30th meridian to the west coast of Europe there